

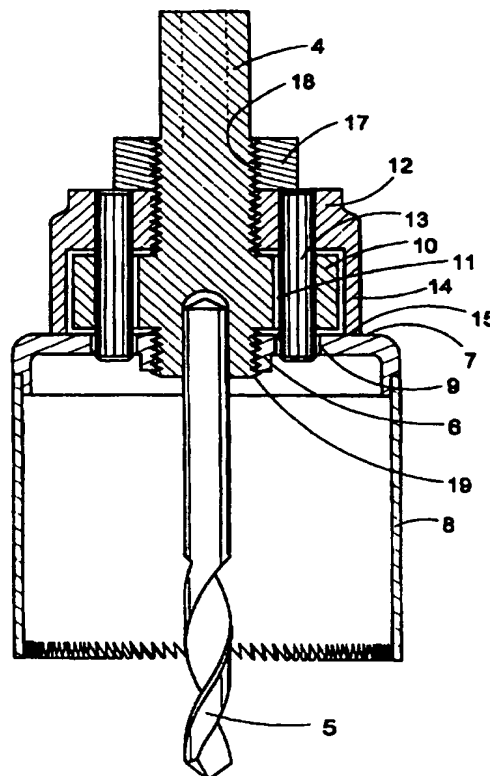
PCTWORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B23B 51/04	A1	(11) International Publication Number: WO 97/15413 (43) International Publication Date: 1 May 1997 (01.05.97)
(21) International Application Number: PCT/SE96/01385 (22) International Filing Date: 28 October 1996 (28.10.96) (30) Priority Data: 9503797-4 27 October 1995 (27.10.95) SE (71) Applicant (for all designated States except US): SANDVIK AB; (publ) [SE/SE]; S-811 81 Sandviken (SE). (72) Inventors; and (75) Inventors/Applicants (for US only): ALM, Sture [SE/SE]; Norra Tornsgatan 12, S-531 30 Lidköping (SE). HOLM, Per [SE/SE]; Vallgatan 25 D, S-531 31 Lidköping (SE). (74) Agent: SUNDSTRÖM, Erik; Sandvik AB, Patent Dept., S-811 81 Sandviken (SE).		(81) Designated States: US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>

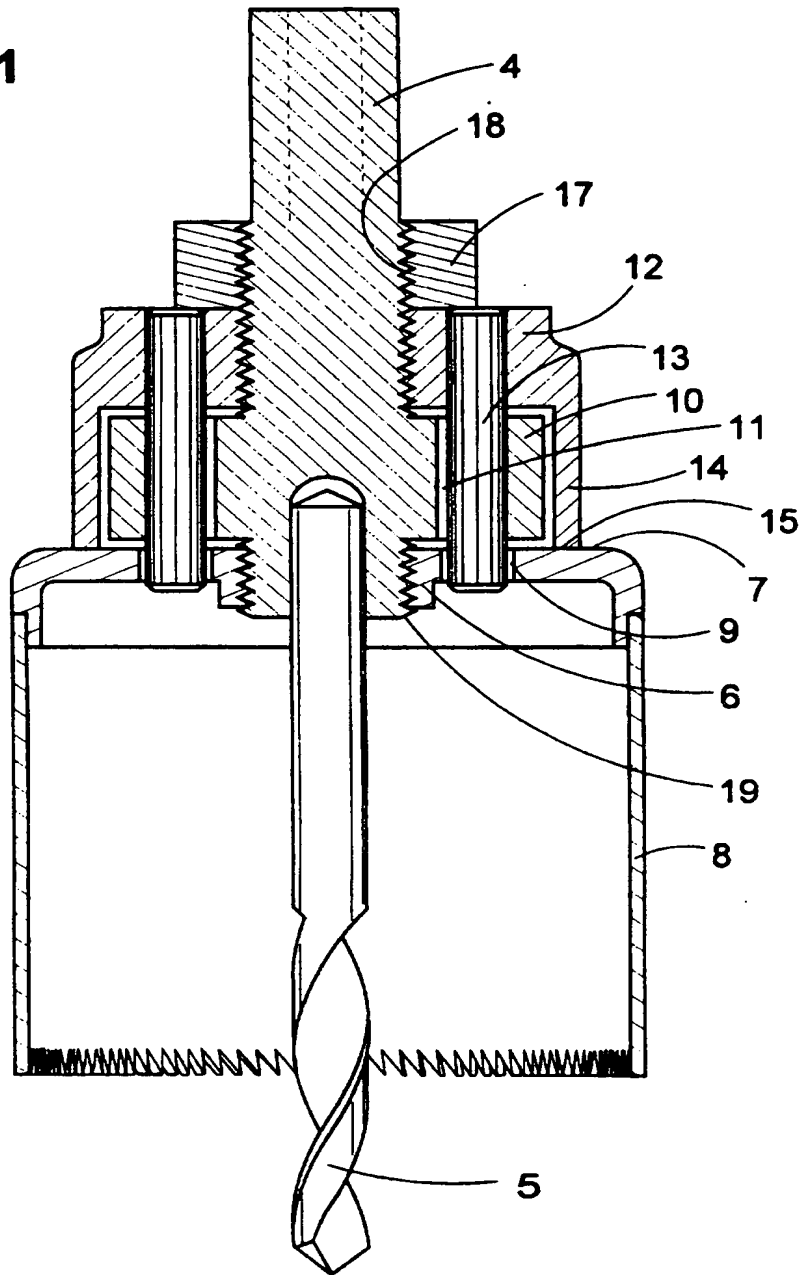
(54) Title: HOLE SAW**(57) Abstract**

Hole saw device comprising an arbor, a cup-shaped hole saw with a center hole and one or more drive apertures, and an axially movable pin carrier constrained to rotate with the arbor provided with drive pins engaging the drive apertures, the pin carrier having a skirt surrounding the drive pins and able to transmit axial force to the hole saw.

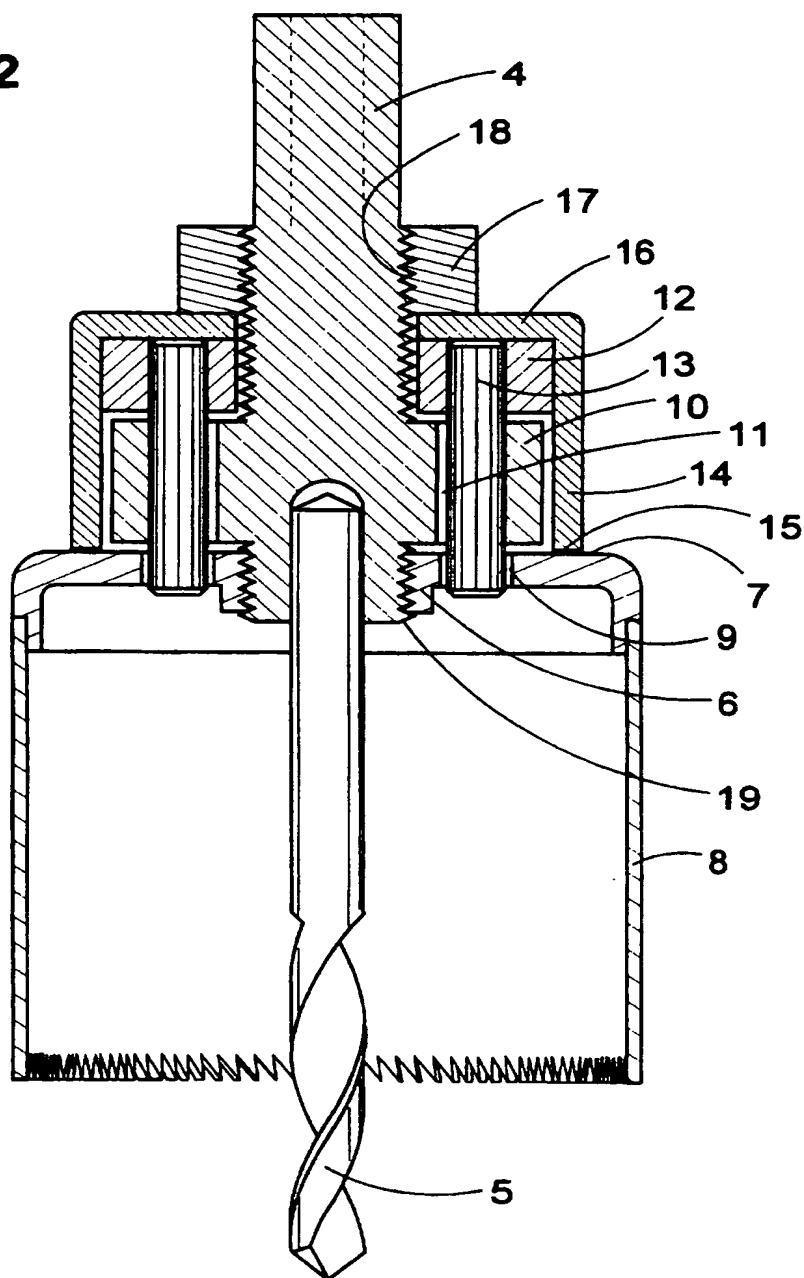


1/2

Fig. 1



2/2

Fig. 2

SUBSTITUTE SHEET (RULE 26)

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgyzstan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	KZ	Kazakhstan	SG	Singapore
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovakia
CM	Cameroon	LR	Liberia	SN	Senegal
CN	China	LT	Lithuania	SZ	Swaziland
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	LV	Latvia	TG	Togo
DE	Germany	MC	Monaco	TJ	Tajikistan
DK	Denmark	MD	Republic of Moldova	TT	Trinidad and Tobago
EE	Estonia	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	UG	Uganda
FI	Finland	MN	Mongolia	US	United States of America
FR	France	MR	Mauritania	UZ	Uzbekistan
GA	Gabon			VN	Viet Nam

HOLE SAW

Background

5 Hole saw devices are used with drill equipment to make round holes of larger diameter than can be made with spiral drills. They require only a limited amount of energy, since only a narrow region has to be turned into chips, and not all of the hole section. Hole saw devices traditionally comprise an arbor with one or more threaded portions, a center drill attached to the arbor, an axially movable pin carrier which is axially movable but constrained to rotate with the arbor and provided with one or more drive pins, and a cup-shaped hole saw screwed onto a 10 threaded portion of the arbor and forced to rotate with the arbor by the drive pins penetrating through drive apertures in a flat part of the hole saw. Such hole saw devices are described in the patents US 4,669,928, US 4,968,189 and others. The pin carrier is commonly constrained to rotate with the arbor by the drive pins extending through guide holes in a flange integral with the arbor, and locked axially by a retaining nut when the drive pins penetrate the drive apertures. 15 Splines or polygonal surfaces may also be used to constrain the carrier.

One feature of such hole saw devices is that apart from the rotation with the arbor, 20 the hole saw proper is located axially and in tilting directions solely by the threads of the arbor, since if it were screwed tight against the termination of the threads, the holes of its flat part might not coincide with the drive pins and the guide holes. The threads are prone to wear, and must anyway be rather loose-fitting to simplify changing of hole saws. Consequently, the hole saw will be rather 25 movable relative to the center drill, except as to rotation. If the teeth of the saw are cutting unequally, such as when making a hole near the edge of a workpiece, or when sawing into a sloping or curved surface, the hole saw will vibrate severely, causing noise, uneven hole surface and rapid wear of the threads. Likewise, transmitting the axial force by the threads to the threaded center hole of 30 the hole saw may cause overloading and deformation of the flat part of the hole saw and thus make the vibration even worse.

Description of the invention

35 The invention concerns an improved hole saw device, where the carrier is provided with an annular support area farther from the arbor centerline than the locking pins. Axial forces will be transmitted to the hole saw through the annular support area instead of through the narrow threads, the threads only transmitting a

small pretension load. The hole saw will then be accurately and stiffly located, with no possibility to rattle or vibrate, and the risk of deformation of the hole saw and premature wear of the threads is much reduced. A further advantage is that the thread may be manufactured with a smoother termination to lower the risk of fatigue cracks.

Description with reference to the drawings

Figure 1 shows a section through one embodiment of the invention, figure 2 a section through another.

The hole saw device comprises: an arbor (4) with an upper threaded part (18) and a lower threaded part (19) and an integral flange (10) with guide holes (11); a center drill (5); a hole saw with a toothed cylindrical part (8) and a flat part (7) with drive apertures (9) and an internally threaded center hole (6); an internally threaded nut (17); and a pin carrier (12) with drive pins (13). The novelty according to the invention is that the pin carrier (12) is provided with a cylindrical skirt (14) extending deeper than the flange (10), but not deeper than the pins (13). The skirt (14) may be made integral with the pin carrier (12) as shown in figure 1, or as shown in figure 2 made as a separate cup-shaped piece (14,16) enclosing the pin carrier and may then be free or attached to the nut (17) or the carrier (12).

When a hole saw (8) is to be removed from the arbor (4), the threaded nut (17) is screwed upwards to allow the pin carrier (12) with the drive pins (13) and the skirt (14) to be lifted clear of the apertures (9) in the flat part (7) of the hole saw. The hole saw can then be rotated relative to the arbor until the threaded center hole (6) leaves the lower threaded arbor part (19) and the hole saw is freely removable.

When a new hole saw is to be attached, it can be screwed onto the lower threaded part (19) of the arbor until it is at a close distance from the termination of the threads at the flange (10). The pin carrier (12) is then slid towards the hole saw with the locking pins (13) guided by the guide holes (11). The hole saw is turned until the apertures (9) in its flat part (7) coincide with the guide holes (11) and the pins can penetrate the apertures (9).

The pin carrier can then be slid further down until the annular support area (15) at the lower edge of the skirt (14) touches the flat part (7) of the hole saw. The nut

(17) is then screwed down to apply pressure to the flat part (7) through the skirt (14). As the nut (17) is tightened, the pressure between the internally threaded hole (6) and the lower threaded arbor part (19) is also increased, but since there is no motion in the thread, no wear occurs. Since any axial sawing feed force is transmitted through the skirt (14) with a larger diameter and not through the threads (19) with a smaller diameter, the flat part (7) will be much less stressed and deformed than if the feed force had to be transmitted through the loose-fitting threads (19).

If the pin carrier is constrained to rotate with the arbor by other means than guide holes in a flange, the requirement that the skirt should reach below the flange does not apply. The threaded center hole and the lower arbor thread may be reduced to a bayonet or twist-lock combination. The annular support surface (15) may be made with one or more interruptions to avoid trapping of lubricant or other debris.

As is common practise, the center drill (5) may be exchanged for a smooth guiding peg if the larger diameter hole made by the cylindrical part (8) of the hole saw is to be centered around a previously made smaller hole. The guiding peg may be fastened to the arbor in the same manner as the center drill (5), or screwed onto the lowest part of the arbor thread (19) below the hole saw. In the latter case, a hole saw of the same smaller diameter as the previously made hole may be used as a guiding peg.

CLAIMS

- 5 1. Hole saw device, comprising an arbor (4), a cup-shaped hole saw with flat upper part (7), the flat part having a center hole (6) and one or more drive apertures (9), and a pin carrier (10) constrained to rotate with the arbor (4) but axially movable to let one or more drive pins (13) engage the drive apertures (9), characterized by the pin carrier (10) provided with a skirt (14) surrounding the drive pins (13), the skirt having an annular contact surface (15) which is pressed against the flat part (7) of the hole saw when the drive pins (13) engage the drive apertures (9).
- 10 2. Hole saw device according to claim 1, where the skirt is integral with the pin carrier.
3. Hole saw device according to claim 1, where the skirt is a separate piece enclosing the pin carrier.
- 15 4. Pin carrier for use in a hole saw device, comprising one or more drive pins (13) for engaging drive apertures (9) in a hole saw, and a skirt (14) with an annular contact surface (15) surrounding the drive pins and able to apply axial force to the hole saw after the drive pins have penetrated the drive apertures (9).

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 96/01385

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: B23B 51/04 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC6: B23B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPODOC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3837759 A (BITTERN), 24 Sept 1974 (24.09.74), figure 1, abstract --	1-4
Y	US 3758221 A (MESHULAM), 11 Sept 1973 (11.09.73), figures 1-3, abstract --	1-4
Y	US 3784316 A (BITTERN), 8 January 1974 (08.01.74), figure 1, abstract --	1-4
A	US 4669928 A (MEDIIVILLA), 2 June 1987 (02.06.87), figures 1-3, abstract --	1-4
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
3 February 1997		10 -02- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Tycho Beckman Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 96/01385

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3647310 A (MORSE), 7 March 1972 (07.03.72), figures 2,9,17,12, abstract --	1-4
A	US 4148593 A (CLARK), 10 April 1979 (10.04.79), figures 1,2, abstract --	1-4
A	GB 2257381 A (ELDON TOOL COMPANY LIMITED), 13 January 1993 (13.01.93), figure 1, abstract -- -----	1-4

INTERNATIONAL SEARCH REPORT
Information on patent family members

28/10/96

International application No.
PCT/SE 96/01385

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3837759	24/09/74	NONE	
US-A- 3758221	11/09/73	GB-A- 1404350	28/08/75
US-A- 3784316	08/01/74	NONE	
US-A- 4669928	02/06/87	NONE	
US-A- 3647310	07/03/72	NONE	
US-A- 4148593	10/04/79	CA-A- 1077807	20/05/80
		DE-A- 2902299	02/08/79
		FR-A,B- 2415509	24/08/79
		GB-A,B- 2013115	08/08/79
		JP-A- 54113589	05/09/79
GB-A- 2257381	13/01/93	NONE	